

Impedance Measurement of Copper Wire by FRA

KEY WORDS

• Copper wire • Transformer • Motor • Copper loss / Iron loss

PRODUCTS

Frequency Response Analyzer FRA5097, Bipolar DC Power Supply BP4610

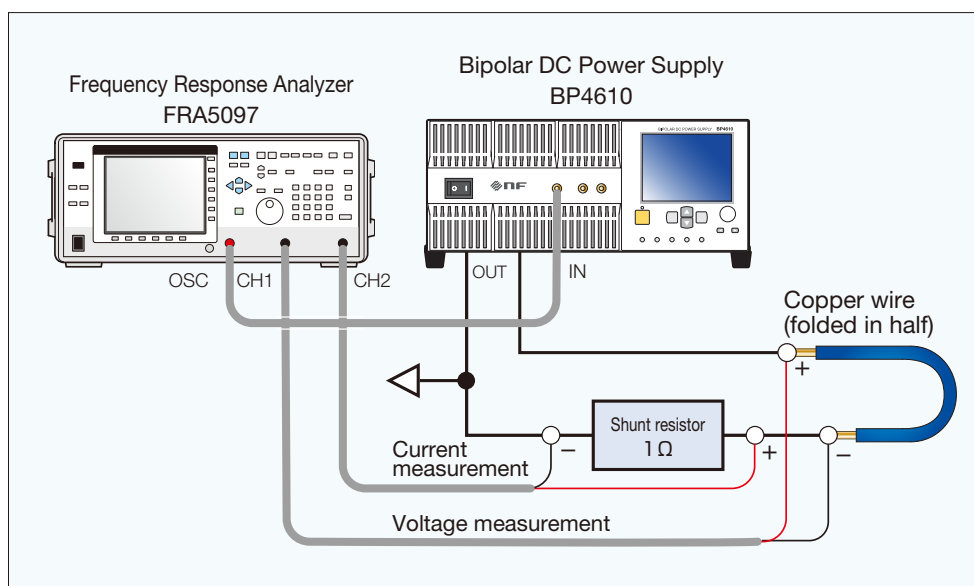
As energy conservation advances, transformers and motors are becoming more efficient. Improvement of efficiency requires reduction of loss (iron loss and copper loss). The parts used in the devices are operating at high frequency. Therefore, we should evaluate the copper wire used in the devices in a state close to the actual condition, that is, at high frequency.

By combining FRA (Frequency Response Analyzer) with Bipolar DC Power Supply operated in CC mode, high frequency impedance characteristics of copper wire can be measured.

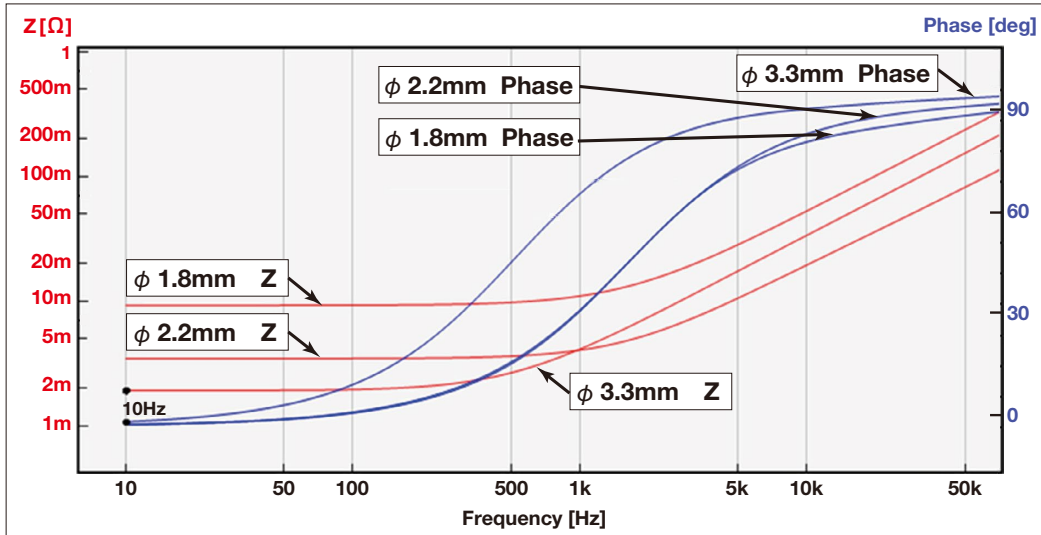
Key Features

- ▶ Constant current operation
- ▶ Measurement can be made with the AC constant current and the DC constant current (bias current) applied
- ▶ Frequency Response Analyzer FRA 5097 can measure and display the impedance frequency characteristics

Measurement Example



■ Measurement Result Impedance/Phase vs. Frequency of 3 Different Diameter Wires



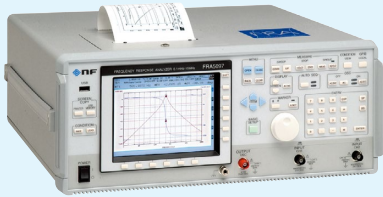
Measurement setup

- Measure the impedance of the copper wire at constant current by Frequency Response Analyzer FRA5097 and Bipolar DC Power Supply (BP4610).
- Measure the voltage across the copper wire and the current flowing through the copper wire using a shunt resistance (1 Ω), and graphically display the impedance frequency characteristics.
- The samples are the impedance of copper wires with different diameters. The current is sine wave 6 Apk, and the frequency range is 10 Hz - 70 kHz.

Measurement result

- The Impedance is constant up to around 100 Hz, the influence due to frequency change is small, but it is considered that the reactance is influencing beyond around 1 kHz.
- The impedance change of copper wire of 3.3 is different compared to others. The wiring shape may be affecting.

Frequency Response Analyzer FRA5087 / FRA5097



FRA5097

FRA5097

For measurement of servo characteristics, loop characteristics, impedance characteristics, resonance characteristics

- Frequency range
FRA5087: 0.1mHz - 10MHz
FRA5097: 0.1mHz - 15MHz
- Amplitude accuracy ± 0.05 dB
- Phase accuracy $\pm 0.3^\circ$
- Dynamic range 140dB
- Isolation voltage 250Vrms max.
- Automatic integration, amplitude compression, calculation function, impedance display function
- Bode diagram, Nyquist diagram, Nichols plot, Cole-Cole plot

Bipolar DC Power Supply BP4610 / BP4620



BP4610

BP4610

Wide range bipolar power supply capable of constant current / constant voltage output

- Output voltage ± 60 V (120 Vp-p)
Available from ± 30 A to ± 100 A
- Output current
BP4610: ± 10 A, BP4620: ± 20 A
Available from ± 30 A to ± 100 A
- Frequency range
DC - 150 kHz maximum (at CV)
DC - 70 kHz at maximum (at CC)
- Voltage / current four quadrant output
- Built-in 255 steps sequential signal source